19. Give an account of quantum theory of ferromagnetism and explain Heisenberg's interpretation of Weiss field.

20. Derive London equation. How do they help in explaining the superconducting state?

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NOVEMBER/DECEMBER 2023

GPH31/DPH31 — CONDENSED MATTER PHYSICS

Time : Three hours Maximum : 75 marks

SECTION A — (10 × 2 = 20 marks)

Answer ALL questions.

1. Show that 48% of a simple cubic structure is void.

2. What is meant by Brillouin zone?

3. Differentiate group and phase velocity.

4. What do you understand by Phonon?

5. State Widemann-Franz law.

6. How is hall coefficient helpful to determine the mobility of charge carriers?

7. Interpret the behavior of rare earth ion on paramagnetism.

8. Distinguish between paramagnetic and ferromagnetic substances.

9. Mention the important property changes that occur in materials when they change from normal to superconducting state.

10. Give the principle of SQUID.

SECTION B — (5 × 5 = 25 marks)

Answer ALL questions.

11. (a) Explain the term symmetry elements in a crystal. Discuss the various types of symmetry elements present in a cube.

Or

(b) Prove that the reciprocal lattice for a simple cubic structure is also simple cubic.

12. (a) Write a note on phonon momentum.

Or

(b) Discuss the dispersion relation for mono atomics lattice.

13. (a) Based on the band theory of solids, explain the nature of metals and semiconductors.

Or

(b) Explain the Hall effect. Derive an expression for the Hall coefficient of semiconductor.

14. (a) Discuss adiabatic demagnetization in paramagnetic salts.

Or

(b) Write a note on the following :

(i) spin waves (ii) magnons

15. (a) Distinguish between type I and type II super conductors.

Or

(b) Discuss d.c Josephson's effect.

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SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. What are Laue equations for diffraction of X-rays by a crystalline solid? Show that the Bragg's equation is a special case of the Laue equations.

17. Derive an expression for the specific heat of solids following the Einstein model. How does the specific heat depends on temperature and onto what extent does this model agrees with the experimental results?

18. Discuss the Kronig-Penny model for the motion of an electron in a periodic potential.